

REMARKS

The application has been amended and is believed to be in condition for allowance.

The Official Action rejected claim 1 under §112, second paragraph, as being indefinite.

Claim 1 has been amended as kindly suggested by the Examiner. Applicants appreciate the Examiner's assistance in this regard. Withdrawal of the indefiniteness rejection is accordingly solicited.

There are no other formal matters outstanding.

Claims 1, 3, 4, 5, 7, and 8 were rejected as obvious over SCHRAM et al. (EP 0 297 637) in view of MAISHEV et al. 6,236,163.

Claim 2 was rejected as obvious over SCHRAM et al. in view of MAISHEV et al. and further in view of YANG et al. 6,397,776.

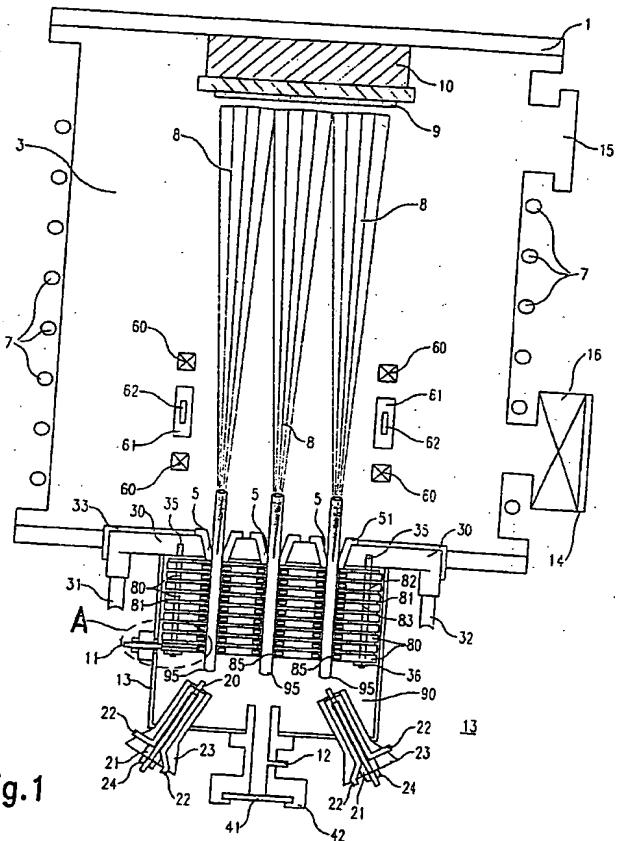
Claim 6 was rejected as obvious over SCHRAM et al. in view of MAISHEV et al. and further in view of SCHAEPKENS 6,681,716.

Claim 9 was rejected as obvious over SCHRAM et al. in view of MAISHEV et al. and YANG et al. and further in view of SCHAEPKENS.

No claims were indicated to be directed to allowable subject matter.

With the formal amendments to claim 1, it is believed that the invention is more clearly recited. Two new independent claims 10-11 are presented which also are believed to patentably recite the present invention.

As disclosed by the application abstract, the invention concerns a device for treating a surface of a substrate (9). See Figure 1 reproduced below:



As shown, the invention includes a treatment chamber for receiving a substrate (9) therein. The substrate includes an exposed substrate area to be treated.

A plasma source generates plural, separated plasma beams, each beam (8) directed to cover a different portion of the exposed substrate area.

The plasma source (13) is provided with a gas inlet (11). See the bottom, left portion of Figure 1. The plasma source (13) also includes at least one cathode and at least one anode.

A system of aligned cascade plates is located between the cathode and anode. The cascade plates are each provided with plural passage openings (also aligned) forming plasma channels to provide plural, separated plasma flow paths. Exiting the plasma source are plural, separated plasma beams (8), each plasma beam being directed to cover a different portion of the exposed substrate area.

With reference to Figure 1, there is illustrated schematically the inventive device. The plasma source/generator 13 and the treatment chamber 3 holding the substrate 9 are each shown.

The plural, separated plasma beams 8 are directed toward a main surface of the substrate 9 (held in position by a substrate holder 10).

According to the invention, each cascade plate 80 comprises plural passage openings 85 (see Figure 3A), with corresponding passage openings substantially aligned in successive cascade plates to thus form a corresponding number of

plasma channels 95. The plasma channels 95 provide separate flow paths for the generated plasma from the nozzle-like anode 5 to cathodes 20. A high-energy plasma arc into which a reactant can be carried and ionized can thus be drawn between anodes 5 and cathodes 20.

Situated preceding the first cascade plate 80 there is a common plasma space 90 which is in open communication with the various passage openings 85 in plates 80. This gives the plasma the opportunity, after being ignited, to spread over the different channels so that three separate beams, and in the case of more openings an even greater number of separate beams, are formed.

Even if the applied references are combined, the references taken in combination or individually do not teach the recitations of the invention as now recited.

As noted above, the present invention provides a device for treating an increased surface area of a substrate with a plasma source. In order to cover a large surface, the device comprises a plasma space, which plasma space is present between the cathode and the system of cascade plates. As recited, each of the cascade plates contains plural passage openings which are aligned with each other to design plural plasma channels. The plasma from the plasma source accumulates within the plasma space and is distributed through the passage openings in the plasma plates as plural, separate plasma beams. In this way, there is

created multiple beams, each of the beams covering a separate and additional substrate area.

The prior art, even as modified and combined as suggested by the Official Action, does not teach such a device.

A drawback of conventional devices using plasma beams for treating surfaces of substrates is the limited cross-section of the plasma beam. This is especially noticeable in the case of larger substrates. In order to obviate this drawback, MAISHEV et al. teach the use of multiple plasma sources to cover a larger surface area, but the use of a plurality of plasma sources tends to render the system unstable. Moreover, the use of multiple plasma sources increases the size and cost of the device. There is no indication whatsoever in MAISHEV et al. to counteract these drawbacks.

Also, a combination with SCHRAM et al. would not lead to the device according to the invention. SCHRAM et al. merely teach to use a system of cascade plates between a plasma source and a substrate with only a single opening. There is no indication in SCHRAM et al., nor is it obvious, to provide a plasma space in front of the cascade plates, or to increase the number of openings in the cascade plates to increase the coverage of the plasma. Therefore, the present invention is both novel and non-obvious over SCHRAM et al. in view of MAISHEV et al.

The same can be said for YANG et al. and SCHAEPKENS. These references both disclose an apparatus that uses multiple

plasma generating means to treat a larger surface of a substrate. These documents, however, neither disclose cascade plates with multiple passage openings between a plasma source and the substrate nor do they disclose a plasma space in front of cascade plates. The invention is hence not at all disclosed or rendered obvious by YANG et al. and/or SCHAEPKENS.

In summary, as the applied art does not teach the particular recited combination of features that represent the present invention, the claims are believed patentable. Reconsideration and allowance of all the pending claims are respectfully requested.

Should there be any matter that can be resolved by telephone in order to place the case in condition for allowance, it is requested that the undersigned attorney be contacted.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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